

# SOUND

What is sound?

- Longitudinal wave
  - alternating areas of high pressure (compressions) and low pressure (rarefactions)
- Frequency is number of oscillations in pressure per second (Hz)
- Velocity depends on temperature of air (at sea level and room temperature:  $v = 343 \text{ m/s}$ )
- Velocity increases  $0.6 \text{ m/s}$  per increase in degree Celsius
- Sound waves show interference like any other wave ("dead spots")

## Echo

- Reflected sound wave
- Time required for echo to return to source can be used to find distance between source and reflector
- e.g. bats, dolphins, SONAR

## Doppler Shift

- The apparent change in the frequency of a wave caused by relative motion between the source of the wave and the observer

<https://www.youtube.com/watch?v=z0EaoilzgGE>

## Applications:

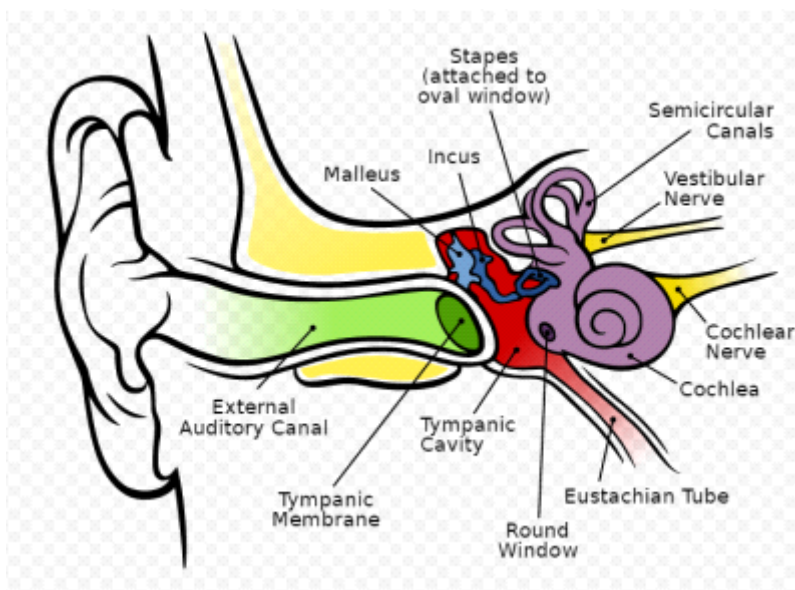
- police radar guns
  - Radar gun sends out radio waves at particular frequency, radio waves strike vehicle and bounce back. Radar gun measures frequency of returning waves.
    - Because car is moving towards gun, frequency of returning waves will be higher than initial gun frequency (faster car = faster frequency of returning wave)
    - Difference between emitted and reflected frequency used to determine speed of car
- Doppler radar
  - Same principle but for storm systems
  - Emitted waves large enough to interact with clouds and other atmospheric objects
  - Clouds or precipitation moving away, reflected frequency decreases, and vice versa
- Echocardiogram
  - Sound waves used to produce images of the heart
  - Sound waves bounce off blood cells and blood vessels - can determine speed and direction of blood

flow

- Sonic boom
  - Bunched up waves reached observer, 'heard' all at once as a loud boom

## THE EAR

<https://www.youtube.com/watch?v=qgdqp-oPb1Q>



# Range of human hearing

